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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/285,986 | 04/05/1999 | SHIH-SHIUNG CHEU | TSMC98-403 | 4368 |

28112 7590 07/29/2003

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28 DAVIS AVENUE
POUGHKEEPSIE, NY 12603

EXAMINER

BEREZNY, NEMA O

| | |
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| ART UNIT | PAPER NUMBER |
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2813

DATE MAILED: 07/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/285,986

Applicant(s)

CHEU ET AL.

Examiner

Nema O Berezny

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 and 27-30 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-25 and 27-30 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 April 1999 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-25 and 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dass et al. (6,143,668) in view of Fu et al. (5,807,787). Dass discloses providing top level interconnecting lines (col.1 lines 26-29) and top level bond pads (Fig.5 el.55) comprising aluminum and aluminum/copper alloy (col.2 lines 42-46), formed on a semiconductor substrate comprising circuit elements therein (col.1 lines 26-33); depositing a passivation layer of silicon nitride over said interconnect lines and said bond pads (el.60; col.2 lines 46-48); depositing a photosensitive polyimide layer (el.65) over said passivation layer; patterning and etching said polyimide layer above said bond pads (Fig.6); then patterning and etching said passivation layer above said bond pads using He/NF(3), thereby exposing said bond pads (Fig.7; col.2 lines 61-62); then curing and cross-linking said polyimide layer (col.2 lines 63-65), wherein said patterned and etched polyimide is not removed (Fig.8; col.2 lines 63-65). However, Dass does not disclose forming an insulating layer over the main semiconductor substrate surface, or depositing two passivation layers, or forming interconnect lines comprising aluminum or aluminum/copper, or forming a bond pad thickness of 4000 – 8000 Angstroms, or

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forming a polyimide thickness of 5.0 – 9.5 microns, or specific claimed deposition, etching, and curing parameters.

Fu discloses a method of forming bonding pads, comprising: forming an insulating film of silicon oxide over the semiconductor substrate main surface (col.4 lines 8-28); depositing two passivation layers using PECVD at a temperature between 350 and 450 degrees C (col.5 lines 18-21), comprising a plasma enhanced oxide layer and a plasma enhanced silicon nitride layer (col.5 lines 14-18) over said insulation layer and over said interconnects and bond pads (col.5 lines 25-26), which comprise aluminum and aluminum/copper alloy (col.4 lines 11-12); and depositing a photosensitive polyimide layer (col.5 lines 37-40) at a thickness of 5.0 – 9.5 microns (col.5 lines 47-49). The two said passivation layers have a thickness of 7000 – 12,000 Angstroms (col.5 lines 23-24); the oxide passivation layer uses Ar/CF(4) as an etchant (col.5 lines 27-30); the bond pad thickness is 4000 – 8000 Angstroms (col.5 lines 8-9); the polyimide is patterned and etched by cross-linking with ultra-violet radiation through a mask, and the non-cross-linked polyimide is dissolved away in a solvent over the bond pads (claim 8), thereby preventing etching damage and damage of cracking and delamination to the passivation layer (Applicant specification – p.21 lines 1-4); and the polyimide is cured in a nitrogen ambient at a temperature of 300 – 400 degrees C for 1.5 – 2.5 hours (claim 9). Fu also discloses filling keyholes (microscopic openings) between closely spaced interconnect lines (col.7 lines 57-61), wherein a thick layer of photosensitive polyimide precursor solution is spin coated over the passivation layers (col.5 lines 40-45) as disclosed by Applicant (specification – p.17 lines 15-21), thereby

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filling any keyholes between interconnect lines. Fu also discloses that said polyimide layer provides a stress buffer and reduces stress impact to the passivation layer (col.5 lines 32-40).

Therefore, it would have been obvious to a person skilled in the art at the time of the invention to use the method of Fu with the method of Dass for forming bonding pads. The two passivation layers of Fu offer the benefits of both an oxide layer, which can relieve stress and therefore avoid cracking, and a nitride layer, which has better moisture resistance than silicon dioxide (Microelectronics Packaging Handbook II, p.477-478). Fu also discloses that PECVD deposition of the passivation layers allows said layers to be deposited at low temperatures (col.5 lines 18-21). Fu also discloses that using a photosensitive polyimide layer provides both a mask and a second passivation layer without the need to etch off photoresist (col.5 lines 37-40). Fu also discloses several items that are typically used in semiconductor fabrication: silicon oxide insulation layer (col.4 lines 13-15); Al/Cu bond pads (col.4 lines 11-13); silicon oxide/silicon nitride passivation layer thickness of 7000-12,000 Angstroms (col.5 lines 23-24); and a passivation etchant of Ar/CF₄ (col.5 lines 25-31), wherein any conventionally used fabrication steps would be economically advantageous in terms of equipment, assembly line set-up, materials, and personnel training.

Dass and Fu do not disclose depositing the first passivation layer at a pressure of 2.0 – 2.8 Torr for 8 – 12 seconds, and the second passivation layer at a pressure of 4.0 – 5.0 Torr for 50 – 60 seconds; or etching the first passivation layer at a pressure of .30 – .40 Torr for 33 – 39 seconds, and the second passivation layer at a pressure of 1.2 –

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1.3 Torr for 20 – 30 seconds. The specification contains no disclosure of either the critical nature of the claimed operating parameters or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Response to Arguments

Applicant's arguments filed 4-29-03 have been fully considered but they are not persuasive. Applicant contends that Dass does not disclose a pattern of metal interconnect lines. Examiner disagrees. As stated in the prior and instant rejections, Dass discloses interconnect lines over the substrate in col.1 lines 26-29.

Applicant also contends that Dass does not provide a thick layer of polyimide to provide for protection of the passivation film. As stated in the prior and instant rejections, Fu discloses a thick (7000 – 12,000 Ang.) passivation layer (col.5 lines 18-24).

Applicant also contends that the pads of Dass are for testing purposes having a pitch of about 80 microns. Examiner disagrees. Dass does not disclose separate or special pads for testing purposes (col.1 lines 12-14; col.1 line 65 – col.2 line 7). In addition, instant application does not claim any pitch size.

Applicant also contends that Fu addresses only bond pads and no interconnect lines. Examiner disagrees. As stated in the prior and instant rejections, Fu discloses closely spaced bond pads and interconnecting lines (col.7 lines 57-61).

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the sequence of steps, and the creation of a bond pad over a semiconductor surface in which a network of interconnect traces has been provided) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant also contends that neither reference taken together or alone addresses several problems stated in Applicant's arguments on p.9 first paragraph, such as problems of surface damage to the passivation layer, providing a surface stress buffer, etc. All of said claimed limitations have been cited in the instant and prior rejections, and a reason for combination for each has been provided.

Applicant also contends that there is no basis for the combination of Dass and Fu. Examiner disagrees. In the prior Office Action, all of page 4 and the top portion of page 5 cite reasons for combination for each rejected claim; said reasons have been repeated in said instant Office Action.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

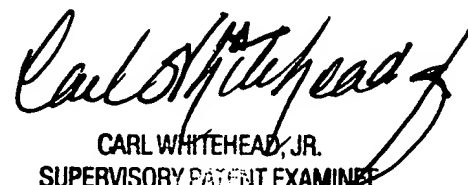
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O Berezny whose telephone number is (703) 305-3445. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

NB
July 17, 2003


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800